SEMESTER EXAMINATION DECEMBER-2023

Course Name: - B.Tech. (CSE) **Semester:- III**

Paper Name: - Discrete Mathematics **Paper Code:-TCS 304**

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. **Max Marks-70**

समय–3 घण्टे+ 20 मिनट प्रति घंट`अतिरिक्त–दृष्टिबाधित एवंसाह लेखक परीक्षार्थियों के लिए। अधिकतम अंक–70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **3 mark. All questions are compulsory.**
- Section B- Answer any **5 out of 7** given questions in maximum one hundred fifty (150) words. Each question carries **7 marks.**
- SectionC- Answer any **2 out of 3** given questions in maximum three hundred (300) words. Each question carries **10 marks.**

निर्देश:

- प्रश्न पत्र में तीन खण्ड अ, ब, व स हैं। सभी खण्ड अनिवार्य हैं।
- खण्ड–अ में प्रत्येक प्रश्न **तीन अंक** का है। **सभी प्रश्न अनिवार्य हैं।**
- खण्ड–ब में **सात प्रश्नों में से किन्हीं पाँच** प्रश्नों के उत्तर अधिकतम 150 शब्दों में दें। प्रत्येक प्रश्न **सात अंक** का है।
- खण्ड–स में **तीन प्रश्नों में से किन्हीं दो** प्रश्नों के उत्तर अधिकतम (250-300) शब्दों में दें। प्रत्येक प्रश्न **10 अंक** का है।

Section – A (खण्ड–अ)

Objective Questions(वस्तुनिष्ठप्रश्न)

1. Answer allthe following questions. **5x3 =15**

निम्नलिखित सभी प्रश्न अनिवार्य हैं।

i) Cardinality of power set A is
   a) $2^{|A|}$
   b) $2|A|$
   c) $|A|^2$
   d) None of these

ii) Which of the following are function
   a) {(1,2), (2,3), (3,1)}
   b) {(1,2), (2,2), (1,3)}
   c) {(1,2), (2,3), (1,1)}
   d) {(1,2), (2,2), (3,2), (4,1) (4,3)}

iii) The sum of coefficients of expansion of $(x + y + z)^{10}$is
   a) 2^{10}
   b) 2^9
   c) 3^{10}
   d) 3^9

iv) If $n_{P_4} : n_{P_3} = 9:1$ the value of n
   a) 9
   b) 8
   c) 24
   d) 39

a) 10
b) 11
c) 12
d) 13

v) The Number of binary relation on a set having n elements is
   a) n^2
   b) 2^n
   c) 2^{n^2}
   d) None of these

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Section – B (खण्ड–ब)
Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions in maximum150 words. **5x7=35**
निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर अधिकतम 150 शब्दों में दें।

i. Write down the truth table of $(p\ q) + r \cong (p + r)(q + r)$

ii. Prove the validity of the following argument: If a man is bachelor, he is happy. If a man is happy, he dies young. Therefore bachelors die young.

iii. Let R be the relation on a set A = {1,2,3,4,5} whose matrix is given below. Draw the directed graph. $A = \begin{bmatrix} 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$

iv. Show that the set of real numbers in uncountable.

v. Show that the necessary and sufficient condition for a non empty subset h of a group G is to be a subgroup is $a \in H, b \in H \rightarrow ab^{-1} \in H$

vi. Prove that every finite integral domain is a field.

vii. A function f is defined on the set of integers as follows: $f(x) = \begin{cases} x + 1, 1 \leq x < 2 \\ 2x - 1,\ 2 \leq x < 4 \\ 3x - 10, 4 \leq x < 6 \end{cases}$

a) Find the domain of the function.
b) Find the range of the function.
c) Find the value of f (4).
d) State whether f is one - one or many one function.

Section – C (खण्ड–स)
Descriptive Questions (विवरणात्मकप्रश्न)

3. Answer any two of the following question in maximum 300 words. **2x10=20**
निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर अधिकतम 300 शब्दों में दें।

i) Define Normal subgroup. Show that a subgroup H of a group G is Normal in G iff $g^{-1}hg \in H\ \forall a \in H$ and $g \in G$.

ii) Define homomorphism and isomorphism. Let G and G' be two groups and $f: G \rightarrow G'$ be a homomorphism then show that (a) f(e) = e' where e and e' are identities of G and G' respectively.

iii) Define kernel of a group. Show that the kernel of a group G is a normal sub-group of G.

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